



MELODY MAKERS

Your recording is almost ready to go, but before you get the perfect sound you need the final mix. Ben Pitt explains the techniques needed to make sweet music sweeter

All you need to produce professional-quality music is your PC, some low-cost hardware, software and the relevant know-how. In *Shopper* 238, we considered what extra equipment is needed and last month we explained how to use this equipment to record music; you'll find PDFs of both features on this month's cover disc. In this final instalment, we'll examine the techniques used to create a final mix. We looked at mixing in *Shopper* 203, and you'll find a PDF of this feature on the cover disc, too.

IDENTIFYING YOUR OBJECTIVES

Once the recording process is complete, the mix is your chance to gather all the pieces of the jigsaw puzzle and present them as a coherent whole. The jigsaw analogy is apt: mixing involves finding the best way to slot lots of disparate things together. However, there is no definitive right way to mix music. Some may argue that louder or heavier or clearer is better, but your criteria will depend on the musical genre, the point of the piece of music, the role of the various instruments and your own tastes.

Just as with the recording process, you should start your mix by considering what you can do to reinforce the composition. Should it be epic or intimate, smooth or aggressive, simple or complex, cosy or bleak? Build up a character profile of the music.

Next, think about the instruments you have recorded. Which are important, and which less so? When music has a vocal, that is usually the most important instrument in the mix, to the extent that every decision you make while mixing should have the ultimate aim of making the vocal sound great. If there isn't a lead vocal, decide which instrument or instruments are the main focus and treat them with the same reverence. Try to ascertain a pecking order for the other instruments. Are the drums and bass virtuoso performances, or do they just support the rest of the band? If there are two guitars, is one more important than the other? They might be equally crucial for creating the overall feel of the track, but a rhythm guitar part doesn't need to be as conspicuous as a lead guitar solo. Of course, the focus of attention may shift at different parts of the track, something we can

accommodate using automation, as explained in the 'Mix and match' box on page 146.

Consider the musical genre in which you are working. You don't have to mix your music in the same way as your contemporaries, but when it comes to music production there's no getting away from fashion, and listeners always draw comparisons. Following standard practices makes a statement about how the music should be perceived. Rejecting these practices makes just as big a statement. Most jazz and folk and all classical recordings aim to re-create the sound of a live performance, which means simulating the acoustics of instruments in a venue and avoiding surreal effects. Nothing is set in stone, but you should be aware of what your listeners would expect to hear so you can decide whether to follow or break conventions.

By the end of this process, you should have a clear set of objectives as to how you want your mix to sound. You might want to create a cosy, intimate but slightly vulnerable mood, with the focus on the lead vocal, followed by the guitar, with drums and bass next on the list of priorities, and keyboards and backing vocals at the bottom



of the pecking order. Perhaps the lyrics have a strong narrative, so you might want a simple, stripped-down approach with no fussy special effects, so the listener focuses on the lyrics.

TOOLING UP

How do you turn complex criteria into mix settings? Again, there are no right and wrong answers, but there are common techniques that can help to get you started. First, though, let's take a look at the tools you'll be using.

Most music-production software (see *Labs*, page 122) comes with a wide range of effects, and there are hundreds more to choose from in the form of VST plug-ins. However, the most important effects are EQ, compression and reverb. Along with the volume and stereo pan controls, these may be all you really need to create a first-class mix. EQ allows you to cut and boost certain frequencies. Compression squashes the volume range, making louder parts of a recording quieter, and vice versa. Reverb simulates the multitude of echoes that give concert halls, stairwells and toilets their distinctive acoustic ambience.

Getting a firm grasp on how to use these effects can be tricky, but you'll find more detailed information in the 'Mixing Music' feature on the cover disc.

Record breakers Comparing your work with others

The best form of education for music production is to listen to what other people have done. Once you've grasped the basic concepts, you should listen to your favourite records and try to recognise the mixing techniques they have used. If it seems a little impenetrable, flick through some MP3s on your PC and make quick comparisons to help you spot different approaches. You'll soon

notice a huge variety in the tone and balance of instruments.

Listening to other people's records can also be useful during mixing projects. It's easy to get lost in the minutiae of a sound and lose sight of the bigger picture. Comparing your mix with a commercial release in the same genre can help you highlight areas that need attention.

CONCEPTS INTO SOUNDS

Let's consider how we might mix our example of a cosy, intimate, vulnerable song. Cosy means warm and soft. Boosting lower-mid frequencies (around 300-600Hz) can increase the warmth of a sound, while cutting higher frequencies (1-2kHz) can smooth out any harshness. This may work for vocals, but cutting at 1-2kHz can reduce intelligibility and female voices often don't go low enough to provide any warmth to boost. Therefore, it may be preferable to add warmth to the guitar rather than the vocal.

Creating intimacy is actually easy. Vocals are often mixes with a fair amount of reverb applied to them to simulate an acoustic space for them to exist in. Using a very short reverb (to simulate a small room) or none at all gives a sense of intimacy. Using heavy compression on the vocal helps, too, as it boosts all the quieter sounds and breaths to give the impression that the singer is very close.

Making a mix sound vulnerable is less obvious, but you might achieve it by choosing certain vocal takes where the performance is a little cracked and imperfect, and perhaps even a little out of tune in an evocatively satisfying way. You could try boosting the very high frequencies (12kHz and upwards) of the vocal for an airy, glass-like quality. Mixing the vocal louder and the other instruments quieter than you normally would can make the vocal seem more exposed and vulnerable, perhaps with plenty of reverb on the instruments so they seem distant from the vocal. This also helps focus the attention clearly on the vocal, with the instruments playing a purely supportive role.

If your objectives are the exact opposite of our example, reverse some of the procedures to get the desired effects. Cutting lower to middle frequencies and boosting higher frequencies gives a colder, more aggressive tone. Applying plenty of reverb to a vocal will give a more epic, spacious sound. Another way to make music sound big and epic is to use double-tracked instruments, where two different performances

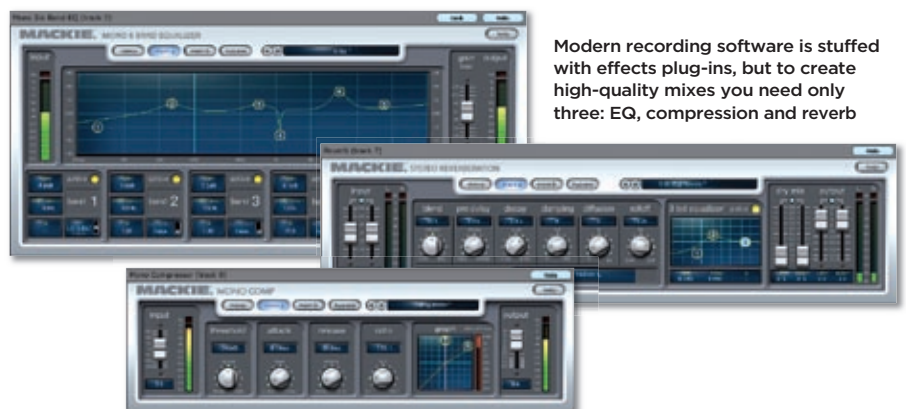
of the same vocal, guitar or other instrument part are played at the same time. This fills out the sound. Panning the two tracks to the left and right speakers gives a huge, attention-grabbing effect. Adding more recordings makes it even bigger, although the clarity of one or two takes may be affected. This can be useful for backing vocals or strings where you want a sound that is larger than life but not necessarily upfront. If you didn't record enough strong performances to use two simultaneously, or if they are so varied they don't meld together well, you can fake the effect by adding a delay effect with a 50ms delay time and no feedback (so it's just a single repeat). Lengthen the delay time slightly for a 'slapback' effect, which has delightfully retro connotations when applied to vocals.

There is a virtually limitless number of human conditions to express, and we can't give a comprehensive overview of the production techniques used to convey them all. If you're stuck for ideas, listen to other people's records for inspiration (see the 'Record breakers' box above). Find a track that has a similar mood to yours and see how it compares to other tracks on the same album. These differences will provide clues to creating a sympathetic mix.

FIXING A HOLE

Finding and realising your artistic vision is the most important part of music production. A technically flawed but inspired mix is more interesting than a competent, uninspired one. However, mixing does involve some corrective or problem-solving jobs, too.

Electric guitars and basses are capable of a huge range of tones, and listeners are used to heavily processed drum sounds, but most people have a strong preconception as to what a voice, acoustic guitar or other acoustic instrument should sound like. You may need to apply some EQ just to make them sound normal. Recorded sounds sometimes suffer from unwanted resonant frequencies, perhaps because reflections in the room have accentuated a certain frequency



Modern recording software is stuffed with effects plug-ins, but to create high-quality mixes you need only three: EQ, compression and reverb



or because the instrument has an unpleasant ring to it. This problem can be removed with a notch EQ setting – a heavy cut with a narrow width setting. To find the problem frequency, start with a heavy boost and sweep through the frequencies until you find the culprit. You can then turn the boost into a cut to remove it.

Vocals often benefit from a presence lift (a gentle EQ boost at around 5kHz) to help with intelligibility. Compressing the vocal can help it sit on top of the other sounds without completely overpowering them. Compression is often routinely used on guitars, basses and drums to help them sound full and solid, and to smooth out any awkward volume changes. However, full and solid isn't ideal for every instrument in every track, so make sure you're improving the track as a whole rather than just the instrument in question when applying EQ and compression.

It's a common misconception that simply making each instrument sound as good as possible in isolation will result in a pleasing mix. This can be true for simple arrangements that comprise two or possibly three instruments, but for larger ensembles the overall balance is more important than each individual instrument.

Mixing everything big and loud usually results in a congested sound where every instrument is competing for the listener's attention and getting in each other's way. Sometimes a jumbled up muddle of instruments is exactly what the track needs, but usually you'll want to give each instrument the space to be heard clearly. Even though you've established which instruments are more and less important, it doesn't mean the less important ones should disappear from earshot altogether.

There are two ways to achieve space and clarity for each instrument, and it's often best to use both techniques together. One is to use EQ to find a space in the frequency spectrum for each instrument. The key frequencies for vocal intelligibility are 1-2kHz, where the vowel formants are. In a lively rock track, it might be worth reducing these frequencies in the guitars to help the vocal cut through without having to turn it up excessively. Similarly, if there is more than one guitar and perhaps some keyboards competing for the middle frequencies, try using extreme EQ settings to carve a frequency niche for each instrument. It might not flatter each sound in isolation, but when heard together

they should lock into a balanced whole, with improved separation and clarity.

The other technique to achieve separation of sounds is to place them at different points on a virtual stage. Stereo speakers make it easy to position sounds from left to right, and by using reverb and EQ it's also possible to simulate the effect of sounds being nearer or further away from the listener. See the 'Mixing Music' feature for details. You don't have to leave instruments in the same position for the entire mix. The 'Mix and match' box on page 146 explains how to use automation to vary mix settings over the course of the track.

BRINGING THE NOISE

A common criticism of digital audio is that it sounds too clean and sterile compared to analogue. After decades of manufacturers producing increasingly accurate equipment, many people now yearn for vintage analogue gear with all its quirks and imperfections. There's no denying that distortion sounds exciting when applied in large quantities to electric guitars, and subtler distortion can be welcome on all sorts of other instruments.

On the right track Understanding audio routing

Mixing in software can get confusing, with audio signals being split, combined and ferried about in a maze of virtual cables. The diagram below should make things clearer.

At the top are all tracks that have been recorded, each feeding a mixer channel. These include eight drum tracks – two overheads (combined as a single stereo channel) plus six spot mics on individual drums – four guitar tracks, a keyboard and a vocal. The rhythm guitar part has been recorded twice, with both takes used simultaneously and panned to left and right speakers to create a double-tracked effect.

Various effects plug-ins have been used on different channels. These are called inserts as they are inserted into the signal flow: the clean sound comes in and the effected sound

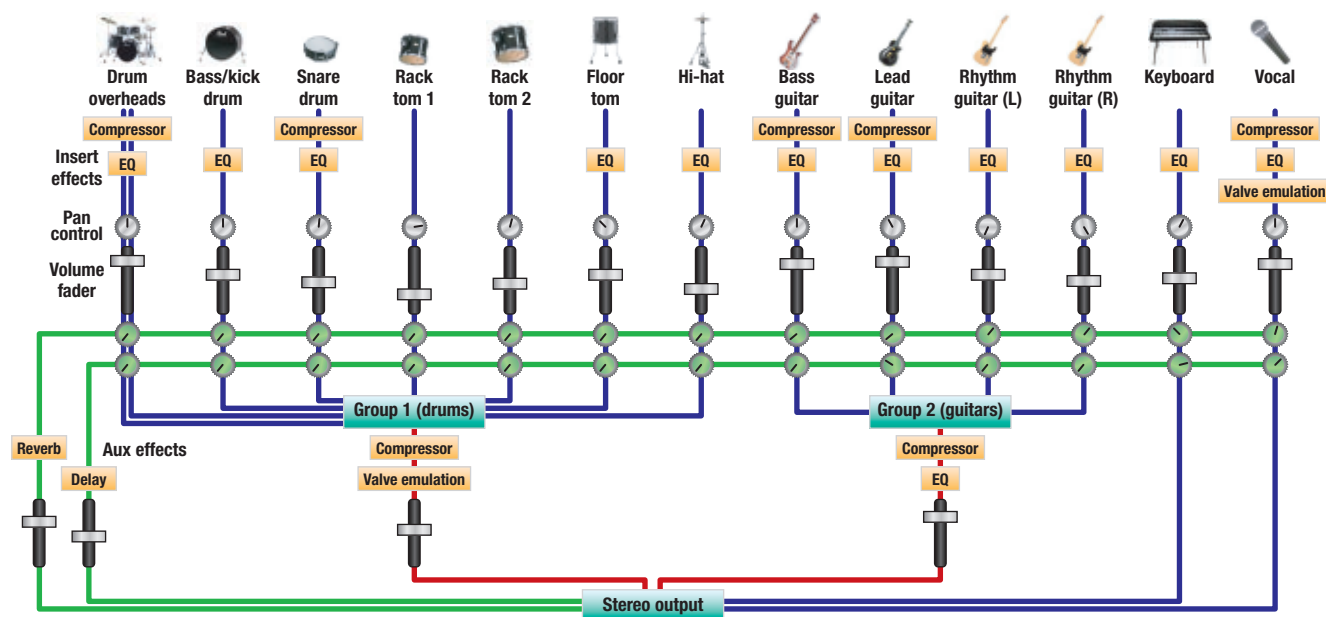
comes out. EQ, compression and distortion would usually be used as an insert effect, as they change the tone of the sound itself.

Each channel also has a stereo pan and volume control and two auxiliary effects sends known as aux sends. These feed a pair of aux effects, shared by all the channels. Having an aux send control on each channel means you can apply varying amounts of the effect to each channel. Reverb and delay are used as aux effects; they add to the sound and don't need to change or replace the original clean signal.

The keyboard and vocal channels are sent straight to the master stereo output, but the drum and guitar channels have been combined into groups (known as buses or subgroups). Doing this has two advantages. Once you have a balanced drum sound, you can adjust the

overall volume of the drums using the group fader rather than trying to adjust each drum channel fader individually. Using groups is also useful for applying insert effects to a number of different channels simultaneously. This makes more efficient use of your processing power compared to applying multiple instances of the same effect to lots of individual channels. It can also have sonic advantages for compression and distortion effects where the various sounds interact with each other as they are processed.

The effects we've used are typical of a pop music production, with lots of compressors used for a full-bodied sound. The pan, volume and aux send controls are also typical. However, exact settings will depend on the tone and volume of your recorded sounds.



▲ Effects plug-ins (shown in orange) can be applied to individual channels (blue), groups of channels (red) or as auxiliaries (green)



This isn't true of all kinds of distortion, though. Overloading a digital input or output causes the tops and bottoms of the waveform to be sheared off. Even a small amount of digital distortion sounds harsh and, to most ears, unpleasant. However, when overloading a valve or a magnetic tape, the onset of distortion isn't as sudden, with the tops and bottoms of the waveform being squashed and reshaped rather than lopped off entirely.

One side effect of distortion is that extra frequencies are generated above existing ones. This is why a distorted guitar sounds brighter than a clean one. Subtle distortion can give the impression of added detail and clarity, even though the process is technically the opposite.

Most distortion plug-ins are designed for guitars, and are better equipped for blues crunches and screaming guitar solos than the effect of a subtly overdriven valve or saturated tape. Voxengo Boogex, a free VST plug-in from www.voxengo.com, handles subtler distortion well. If certain instruments in your recording sound lifeless, insert this effect and use a Drive value of 5-10dB to give it more sparkle. Switch off Speaker Cabinet Impulse Response, which emulates the sound of an instrument playing through a guitar cabinet speaker.

Don't use distortion as a quick fix without paying attention to EQ and compression effects, too. Adding a touch of distortion can make an instrument sound more exciting, but go too far and the mix will sound wearying, or as though you have distorted sounds by accident.

MIXING DOWN

As you add more and more sounds to the mix and shape them with effects, it's easy to overload the output of your recording software. This causes digital distortion, as described above, which should definitely be avoided. Most recording software makes it clear when this is happening – usually with red overload lights on the output meter that stay illuminated until they are clicked to be reset. If this happens, simply turn down the master (main output) volume fader until the problem disappears. You should also keep an eye out for overloaded input and outputs to plug-ins, such as when a heavy EQ boost overloads the EQ plug-in's output. This is more of a pain to remedy, as you might need to turn down various other channels to preserve your overall balance.

When your mix is complete, define the start and end points of your track using the In and Out markers, leaving enough time at the end for any reverb or delay to fade out. Double-check that the output isn't overloading, find your



▲ Mastering limiters such as Kjaerhus Audio's Classic Master Limiter boost the level of a mix without distorting it, while Mackie Tracktion's Final Mix plug-in has tools for optimising a mix

Mix and match Automation explained

The perfect mix settings for the verses of a song might not be the same as those for the chorus. Automation allows you to vary mixer settings as the track progresses. It can be useful for when an instrument has such widely varying levels that applying compression isn't enough to keep it under control. It also has creative uses, such as for creating fade-ins and fade-outs.

It's often helpful to have a lift in energy during the choruses or finale; this can be achieved by increasing the volume of the guitars or another instrument. Automation needn't just apply to level changes. You can create interest by adding an effect for one section. You can also bring an instrument to the foreground during a solo by increasing its volume and decreasing the reverb.

In most music-production software, automated setting changes can be clip-based or channel-based. Each audio clip has its own volume setting. This is a static value, but by splitting a clip into two you can set different values for the first and second parts. Most

software also allows clips to be faded in and out, which is useful for tidying up the end of the track as well as creating slow fades.

You can also program changes of the mixer settings either by drawing curves on to an automation track or by recording knob and fader movements in real time. The latter can feel more intuitive, but can also be tricky to control with a mouse, and editing existing automation can lead to complications. We recommend drawing automation on to the arrange window for greater control.

Clip-based and channel-based automation lend themselves to different tasks. Use whichever method seems most convenient. Bear in mind that when you adjust the level of an audio clip, it is applied before the signal is sent through any insert effects. Channel-based volume automation is applied after the effects. It doesn't make much difference for EQ, reverb and delay effects, but it matters when applying compression and distortion, as these effects behave differently depending on how loud the input volume is.



◀ Create volume changes by drawing automation curves, using fade-in and fade-out controls or adjusting the relative volume of different adjacent audio clips

software's export command and export as a 24-bit Wav file at whatever sample rate you've been working at, probably 44.1kHz.

This exported file isn't your final mix. All commercial music goes through an additional stage called mastering. This is usually conducted by a specialist mastering engineer in a different studio, whose job it is to apply effects to the whole mix to iron out any problem frequencies and make the mix as loud as possible. With mastering engineers charging from around £35 per track, it usually isn't practical for home studio producers to send off their mixes for professional mastering. However, it's worth having a go yourself, if only to boost the overall level so it competes with commercial CDs.

To boost the overall volume of your mix without distorting it, you'll need an effect called a limiter. This is a compressor that stops the volume getting any louder than the specified threshold. Not all recording software includes a limiter effect, but Kjaerhus Audio's Classic Master Limiter from www.kjaerhusaudio.com is a decent, free VST plug-in. Mackie Tracktion users have the very capable Final Mix plug-in. It's pretty complex to use, but there are plenty of presets with which new users can experiment.

Import your mix into a new project and apply a limiter plug-in to the channel in question. The threshold setting dictates how much volume increase is applied, but go too far and your mix will start to sound congested. You might want to apply some gentle EQ, perhaps to add a little high-frequency sparkle and remove very low bass, and a little compression to help the sounds gel together. If so, apply these effects before the limiter in the chain to avoid distorting the output. When you're ready, export your mastered mix as a 16-bit Wav file, ready to burn to CD or convert to MP3 format.

IT'S NOT OVER YET

Your finished mix is the end of one journey, but the start of another. Play it to friends and try to get some honest feedback. A MySpace music account is an excellent way to get heard by a wider audience, and it's essential for bands and musicians hoping to get noticed. If the demand is there, use products such as Actinic Audio Store (*What's New, Shopper* 209) to sell CDs and MP3s from your website, or contact www.aval.co.uk, which can upload your music to iTunes and other music download stores. And if you fancy posting us a CD, we'd love to hear it. ☐